

**CERTIFICATE OF MAILING BY FIRST CLASS MAIL (37 CFR 1.8)**Applicant(s): **Walter J. Smith**

Docket No.

**1370.002A**

Application No.

**10/805,084**

Filing Date

**03/19/2004**

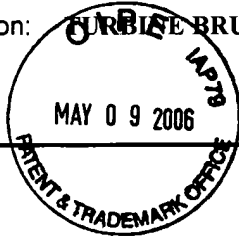
Examiner

**Yao, Samchuan Cua**

Customer No.

**23405**

Group Art Unit

**1733**Invention: **TURBINE BRUSH SEAL**I hereby certify that this **Declaration of Wayne F. Reinke Under 37 C.F.R. Section 1.131**

(Identify type of correspondence)

is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope

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**May 5**, 2006

(Date)

**Rosalind Q. Spiller**

(Typed or Printed Name of Person Mailing Correspondence)

A handwritten signature in cursive script that reads "Rosalind Q. Spiller".

(Signature of Person Mailing Correspondence)

**Note: Each paper must have its own certificate of mailing.**



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Walter J. Smith                      Confirmation No.: 7707  
Serial No.: 10/805,084                      Group Art Unit: 1733  
Filed: 03/19/2004                      Examiner: Yao, Samchuan Cua  
Title: TURBINE BRUSH SEAL

To: Mail Stop AF  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**DECLARATION OF WAYNE F. REINKE UNDER 37 C.F.R. §1.131**

I, Wayne F. Reinke, do hereby declare that:

1. I am the patent attorney of record in the above-noted matter.
2. I am also the attorney of record in the parent case, U.S. Patent Application Serial No. 09/999,664.
3. Attached hereto as Exhibit A is a true copy of a letter dated May 30, 2000 from myself to Walter J. Smith, the listed inventor on both the present case and the parent case. The letter references an enclosed draft patent application in the parent case being sent to Mr. Smith for comment prior to filing.
4. On August 17, 2000, I met with Mr. Smith at my office in Albany, New York, to discuss the parent draft application. Attached hereto as Exhibit B is a true copy of a bill sent to Mr. Smith in September 2000, showing an entry for the office conference.
5. During the course of the August 17, 2000 office conference, I received from Mr. Smith hand written comments to the draft application, along with other notes and sketches.

Attached hereto as Exhibit C is a true copy of the handwritten comments on the draft application that was sent to him with the May 30, 2000 letter, received from Mr. Smith during that meeting.

6. Also received from Mr. Smith during the August 17, 2000 conference are additional pages of notes and drawings (see Exhibit C), among them a page of graph paper referencing pages 13, 16 and 4 of the draft application, and including sketches of various cross-sectional shapes for the filaments of the invention. The sketches include a three-point star shape, a four-point star shape, and a five-point star shape, each of which conforms to the definition of "n-point star" given in the present application at numbered paragraph 0039:

"n-point star" shape refers to a shape that has at least three arms (i.e.,  $n \geq 3$ ), the faces of each arm extending from the body of the star and meeting either actually or extendedly in a sharp point, and where an angle between the faces of adjacent arms (either the actual angle if the faces meet at a point, or angle between the extensions of the faces if they meet at a radiused area) is less than 180 degrees from the perspective of outside the filament looking into the filament.

7. Attached hereto as Exhibit D is a true copy of the official filing receipt in the parent case showing a filing date of October 25, 2001.

8. On February 5, 2004, the Applicant, Walter J. Smith, came to my office to discuss the final Office Action in the parent case, dated October 22, 2004.

9. Attached hereto as Exhibit E is a true copy of a bill sent to Mr. Smith in March 2004 showing an office conference with Mr. Smith on February 5, 2004.

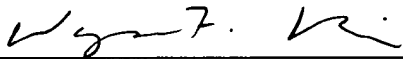
10. During the course of the February 5, 2004 conference, it was decided that the previous claim strategy in the parent case reciting included angles was not being interpreted as originally intended. Instead, it was decided to rephrase the claims for the filament to a cross-sectional shape of an n-point star, where "n" is three or more.

11. Attached hereto as Exhibit F is a true copy of my handwritten notes from that conference describing the n-point star shape.

12. Attached hereto as Exhibit G is a true copy of the official filing receipt for the present application, showing a filing date of March 19, 2004.

13. The filings in the parent case made of record at the U.S. Patent and Trademark Office show that all were filed during the statutorily allowed dates for responses and such.

14. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

  
\_\_\_\_\_  
Wayne F. Reinke

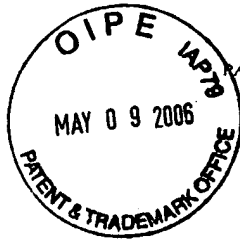
Date: May 5, 2006

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DANIEL H. BEATY  
VICTOR A. CARDONA  
LEE PALMATEER

May 30, 2000

Mr. Walter J. Smith  
88 Chester Street  
Ballston Spa, New York 12020

Re: U.S. Patent Application  
Title: BRUSH SEAL AND METHOD AND SYSTEM FOR  
INSTALLING SAME  
Our File No.: 1370.002

Dear Mr. Smith:

Enclosed is a copy of a draft patent application and informal drawings prepared on the subject invention. Please carefully review this application for accuracy and completeness. Any necessary additional information, comments, suggestions, questions or the like should be marked right on the copy. In that regard, please note the questions in bold throughout the application.

Rule 1.56 of the U.S. Patent Office Rules of Practice states that a duty of candor and good faith towards the Office rests with the inventor. This includes a duty to disclose to the Patent Office information which the inventors are aware of which is material to the examination of the patent application. Failure to disclose material information known by the applicants can result in invalidation of some or all of the claims. Information is considered material when it is not cumulative to information already of record and the information:

- (1) establishes, by itself or in combination with other information, a case which, on the face of it, would render any claim unpatentable;  
or
- (2) it refutes, or is inconsistent with, positions taken by us in arguing for patentability.

In order to fulfill this duty, it is important that you advise us of the following:

- (a) Relevant prior art, i.e., patents, printed publications or other information relating to similar work done in the past by others.

Mr. Walter J. Smith  
May 30, 2000  
Page 2

- (b) Information relating to any public use, sale, offer for sale (e.g., proposal) or printed description of your invention.
- (c) Any other information you feel might be considered "material."

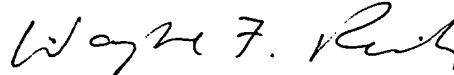
To assist you in this effort, enclosed is a list of references of which we are already aware. After carefully reviewing the enclosed list and patent application, please indicate below any additional information of which you are aware that might be material to the examination by the Patent Office of said application. If there is no additional information, please so indicate.

Also, kindly indicate or confirm the existence of any U.S. Government sponsorship of this invention, in the space provided below. If you have any question as to what constitutes U.S. Government sponsorship, please call us.

After your review, please contact me with your comments.

Very truly yours,

HESLIN & ROTHENBERG, P.C.



Wayne F. Reinke

Email: [wfr@hriplaw.com](mailto:wfr@hriplaw.com)

WFR:rqs  
Enclosures  
N:\USERS\STAFF\RQS\2000\1370002.156

\_\_\_\_\_ I AM NOT AWARE OF ANY ADDITIONAL INFORMATION MATERIAL TO  
THE EXAMINATION OF THE APPLICATION BY THE PATENT OFFICE.

-or-

\_\_\_\_\_ THE BELOW-IDENTIFIED INFORMATION MAY BE MATERIAL TO THE  
EXAMINATION OF THE APPLICATION BY THE PATENT OFFICE:

U.S. Government Sponsorship of invention:

\_\_\_\_\_ NO \_\_\_\_\_ YES: Agency: \_\_\_\_\_

Contract or Grant No.: \_\_\_\_\_

\_\_\_\_\_  
Date

\_\_\_\_\_  
Inventor Signature

TO VERIFY THE ACCURACY OF OUR RECORDS, WOULD YOU KINDLY COMPLETE  
THE FOLLOWING (PLEASE PRINT):

\_\_\_\_\_  
First Name Middle Last

\_\_\_\_\_  
Residence Address: Street City County State Zip Country

\_\_\_\_\_  
Post Office Address—if different from residence

Citizenship: \_\_\_\_\_ U.S.A. \_\_\_\_\_ Other: \_\_\_\_\_

# Heslin & Rothenberg, P.C.

5 Columbia Circle  
Albany, New York 12203

September 11, 2000

Mr. Walter J. Smith  
88 Chester Street  
Ballston Spa, NY 12020



Invoice# 65838 WR  
Our file# 1370 002  
Billing through 08/31/2000

## Brush Seal

### PROFESSIONAL SERVICES

08/17/2000 Office conference with Walt Smith regarding his comments to draft patent application.

### FEES

Member 3	2.00	Hours	<u>\$380.00</u>
			\$380.00

### EXPENSES

#### Billing Summary

Total professional services	\$380.00
	-----
Total of new charges for this invoice	\$380.00
Less trust amount applied to this invoice **	\$380.00 CR
	-----

#### **Total balance now due**

\$0.00

\* Prepaid cash remaining balance is \$0.00

\*\* Trust account remaining balance is \$1,688.88



Page 13 - claim #19 "filament has non-circular cross-sectional shape . . . and

Page 16 - claim #37

Page 4 - fig 9 -



any shape that has corners, included angles, flat surfaces, or concave surfaces will have a higher flow resistance coefficient than a round shape.

the corners of these shapes will need to be rounded slightly to reduce abrasion with adjacent bristles

BEST AVAILABLE COPY

**METHOD, APPARATUS AND SYSTEM FOR CREATING A BRUSH SEAL****BACKGROUND OF THE INVENTION**

## Technical Field

The present invention generally relates to brush seals. More particularly, the present  
5 invention relates to the creation of brush seals using electrostatic flocking.

## Background Information

In the past, large rotating element machines, such as, for example, turbines,  
incorporated labyrinth seals to reduce losses between high and low pressure areas, resulting  
in efficiency losses for the machine. As one skilled in the art will know, labyrinth seals  
10 comprise spaced hard "teeth" projecting out from, e.g., a stationary <sup>or rotating</sup> element, and almost  
touching the corresponding rotating <sup>or stationary</sup> member when at rest. At start up, the teeth would often  
contact the corresponding member, due to thermal expansion and contraction leading to  
radial and axial growth disparities between stationary and rotating members, causing damage  
to that member and/or the teeth. Further damage is possible, due to vibration when critical  
15 speeds are reached. This damage would lead to ~~pressure losses~~ <sup>leakage which increases</sup>, and, hence, efficiency losses.  
This problem was addressed by providing additional space between the teeth and the  
corresponding member. However, this too reduced efficiency, since it left a slight gap  
between the teeth and corresponding member during operation.

Pressures are  
fixed by flow path  
geometry and don't  
change appreciably  
but secondary  
leakage flows increase

-2-

Further improvements to the basic labyrinth structure included the addition of a "honeycomb" erodible element on the member opposite the teeth. This allowed the teeth to wear away the honeycomb element without physical damage to the corresponding member *or the teeth* during startup. Although the resulting gap was smaller than prior to the inclusion of the honeycomb element, there was still an unacceptable efficiency loss. This led to brushes with flexible filaments that would bend during start up. These flexible filaments produced the smallest gap yet during normal operation.

*Presently, the flexible filaments are cut longer than ultimately needed, taking into account ~~eventual partial wearing away~~ <sup>Post manufacturing Trimming</sup>. In addition, the filaments are manually stacked in some fashion. Typically, the filaments are welded between two metal rings, referred to as "sealing rings." However, up to two thirds of the space needed for the brush seal can be used by the rings. The space needed for the sealing rings is, thus, a limiting factor to the available seal <sup>width</sup> *actual seal length on a circumferential seal* "length" (an industry term referring to the width of the filaments between the sealing rings). The process of compressing the sealing rings and the filaments together for welding and cutting the filaments to length is also labor intensive.*

Thus, a need exists for a way to increase the available seal <sup>width</sup> length and, therefore, increase efficiency. *(the pressure on each bristle/filament reduces as the overall length of the seal increases, allowing sealed at higher pressure differentials)* *inversely proportional*

### SUMMARY OF THE INVENTION

Briefly, the present invention satisfies the need for a way to increase the available seal length in a brush seal by replacing the sealing-ring arrangement with a bonding agent and

*the force on each bristle is inversely proportional to the overall seal length*

*in bono chimney*  
*yes*

flexible filaments electrostatically flocked into the bonding agent. This allows for a much larger seal width, and improved efficiency, at a lower cost.

In accordance with the above, it is an object of the present invention to provide a brush seal with a larger seal width than currently available, *for a given geometry*

*with*

5 The present invention provides, in a first aspect, a method of creating a brush seal. The method comprises applying a bonding agent to a member, either stationary or rotating, and electrostatically flocking a plurality of flexible filaments into the bonding agent to create the brush seal.

The present invention also provides apparatus and system aspects implementing the  
10 method of the present invention.

These, and other objects, features and advantages of this invention will become apparent from the following detailed description of the various aspects of the invention taken in conjunction with the accompanying drawings.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

15 FIG. 1 depicts a bonding agent being applied within a groove of a member.

FIG. 2 depicts the member of FIG. 1 with flexible filaments electrostatically flocked into the bonding agent.

FIG. 3 depicts the member of FIG. 2 with the flexible filaments being angled.

FIGs. 4-8 depict alternate embodiments of brush seals in accordance with the present invention.

*Fig 9 - depicts optional cross sectional shapes of the individual brush bristles*  
**BEST MODE FOR CARRYING OUT THE INVENTION**

5 A method of creating a brush seal will now be described with reference to an example depicted in FIGs. 1-3. FIG. 1 depicts a cylindrical member 100 with a groove 102 machined therein. Cylindrical member 100 is, for example, a ~~rotating shaft~~ <sup>rotating shaft</sup>, for example, a turbine. Groove 102 is, for example, <sup>0.2"</sup> deep ~~[HOW DEEP?]~~, and is machined using, for example, ~~A LATHE~~ <sup>A LATHE</sup>. A bonding agent 104 is evenly applied to the grooved area via spray applicator 106, while cylindrical member 100 is slowly rotated such that the bonding agent remains evenly distributed and does not drip off. Spray applicator 106 is, for example, an automated spray applicator, similar to that used for conformal coating of electronic components ~~[TRUE?]~~. Bonding agent 104 is, for example, a molten ceramic or ~~other~~ <sup>Molten Metal</sup> material, such as, for example, ~~[NEED EXAMPLE]~~ <sup>a high temp. Braise</sup>. As one skilled in the art will know, a ~~material~~ <sup>"STOP OFF"</sup> is ~~[NEED DESCRIPTION]~~, and is useful, for example, when an area of the groove is sought to be left without any brush seal filaments. [PLEASE CONFIRM HOW AREAS ARE

~~used to~~ <sup>used to</sup> LEFT OPEN - SEE CLAIM 9.]

*keep certain areas from being wetted by a braise and therefore not allowing the braise to adhere to the surface in those areas*  
 20 In the present example, bonding agent 104 is evenly distributed over the surface of groove 102. However, it will be understood that the bonding agent could be unevenly distributed <sup>OK</sup> ~~[TRUE?]~~, for example, if one or more areas of the groove are sought to be left without the bonding agent. In addition, it will be understood that the groove is not necessary

*Add a sentence about the arbitrary action prevention*

-5-

for the basic invention. The bonding agent can be applied to any surface of a member. It will also be understood that spray applicator 106 could be manually controlled, or instead be a brush or other type of applicator. Further, cylindrical member 100 need not be rotated during bonding agent application; instead, the applicator could be manipulated (e.g., rotated) about the groove.

FIG. 2 depicts the cylindrical member 100 of FIG. 1 after the application of bonding agent 104 to groove 102. As shown, a plurality of flexible filaments 200 are being electrostatically flocked into the bonding agent via flocking apparatus 202. The filaments are flexible so that during start-up, there is some "give" in the face of thermal expansion and contraction. The flocking is done while cylindrical member 100 is slowly rotated, or, alternatively, while cylindrical member 100 remains in place and flocking apparatus 202 is manipulated about the groove. Flocking apparatus 202 comprises, for example, flocking gun 204, compressor 206, and hopper 208 to hold flexible filaments 200. The flexible filaments could be precut or cut to size after application. The compressor at one end 210 of gun 204 allows the filaments to be drawn out of hopper 208 and "shot" into bonding agent 104 at the other end 212. The flocking process can be automated or manual. In this manner, a brush seal is created with a longer seal <sup>width</sup> length for a given geometry, and expressly without the need for sealing rings to stack to filaments and weld to the member. With a longer seal length, the filaments can also be smaller in cross-section, which reduces friction and improves flexibility. ~~This should translate into much less damage and less maintenance.~~

*as well as assisting in*  
 Although compressor 206 might assist to some small extent in propelling filaments 200 into bonding agent 104, ~~the potential difference that does so.~~ *on electrical potential difference also does so.*  
 Flocking gun 204 is kept at a positive direct current (DC) potential ~~[HOW?]~~ *from a power supply*, while cylindrical member 100 is kept at

*I'm not sure if more elaboration is warranted here.*

*this will provide a more flexible seal with minimal wear of the bristles and bearing surface.*

*or AC Potential or reverse polarity*

*melt adhesive remelt point must be above the running temp of the machine*

-6-

a negative DC potential [HOW?], which causes filaments 200 exiting gun 204 at end 212 to be attracted to the ~~negative~~ *opposite polarity* potential. Further, the potential difference will also cause the filaments to align perpendicular to the surface into which they are shot, or, in this case, perpendicular to the normal of the surface where curved. The potential difference is, for example, about 15,000 volts DC.

Flexible filaments 200 are made of, for example, metal (e.g., *Haynes 25 (cobalt alloy) or ceramic* [NEED EXAMPLE]) fiberglass, Carbon fiber, Ceramic and preferably cut to length or slightly longer to allow for some degree of wearing from friction. However, where the filaments are made of metal or any other material that can hold a charge, they will begin to stick together upon exiting the flocking gun (or before) if left alone. Thus, the conducting filaments are preferably coated with an electrical insulator, such as, for example, an oxide, so long as the melting point of the insulator is higher than that of the bonding agent for hot applications. The insulator could be applied in a number of ways. For example, the metal filaments could be placed in a fluidized bed of the insulator material and removed, so as to fully coat them. *or applied to the rotor before it is cut to length and compressional size* [ANY OTHER WAYS TO DO IT?] The addition of the electrical insulator does, of course, change the stiffness of the filaments, which would need to be considered when the filaments are being designed for the particular purpose.

In cold applications, i.e., where the bonding agent is not hot during electrostatic flocking, the flexible filaments are preferably non-conductive. For example, the filaments could comprise glass, polyimide, nylon or rayon. In such applications, bonding agents such as, for example, epoxies and rubber adhesives could be used. *a conductive powder may want to be added if the bonding agent is of high electrical resistance*

As noted above, the electrostatic flocking process results in the flexible filaments being aligned perpendicular to the surface coated with the bonding agent. For some

applications, it may be desired that the flexible filaments be angled, rather than perpendicular, to the surface or normal of the member. FIG. 3 depicts cylindrical element 100 after flexible filaments 200 have been electrostatically flocked into bonding agent 104 before it hardens. Angle adjustment tool 300 is brought into contact with flexible filaments 200, and is simply a surface with which filaments 200 come into contact during rotation with respect to cylindrical element 100 such that the angle thereof changes to a desired angle. In the present example, angle adjustment tool is simply a shaft with a smooth face that is brought into contact with the flexible filaments prior to hardening of the bonding agent. For example, although opinions differ on the issue, filament angles for turbines are currently thought to be nominally best at about 45 degrees with respect to the normal of the surface.

Alternatively, angle adjustment tool 300 could have, for example, a grooved face such that

~~not all of the filaments become angled, or so that some are angled to a lesser or greater extent~~

~~than others. [IS THAT THE PURPOSE FOR GROOVED FACE?]~~

*the filaments are held in position in the axial direction while being tipped in the circumferential direction (controls axial spread of filament tips)*

FIGs. 4 through 8 present examples of alternative embodiments for the brush seal of the present invention. FIG. 4 depicts a retrofitted labyrinth seal 400, comprising a first member 402 and a second member 404. One of members 402 and 404 rotates relative to the other. In the example of FIG. 4, labyrinth teeth 406, 408 and 410 extend out of member 402 toward member 404. The labyrinth teeth are inflexible metal. Member 404 comprises a groove 412 in which flexible filaments 414 have been electrostatically flocked into a bonding agent 416 applied thereto. The filaments coinciding with the locations of the labyrinth teeth have been sized appropriately. In this manner, a labyrinth seal can be retrofitted to include the brush seal of the present invention, while not removing the labyrinth teeth.

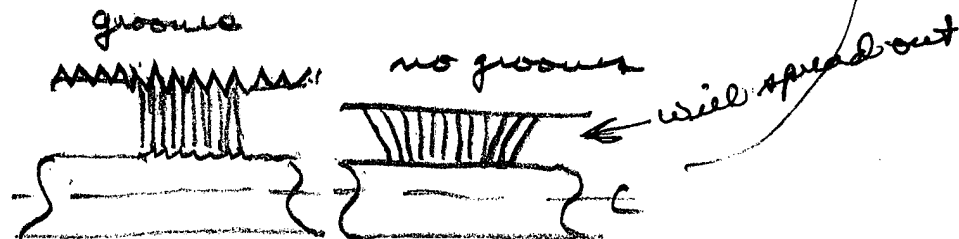
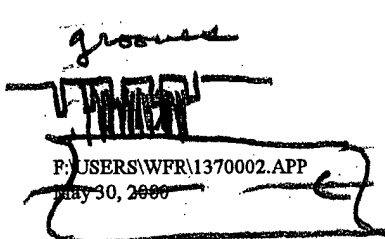




FIG. 5 depicts another embodiment of a retrofitted labyrinth brush seal 500. Like seal 400, seal 500 has a member 502 with labyrinth teeth 504, 506 and 508 extending therefrom toward another member 510. One of members 502 and 510 rotates relative to the other. Member 502 also includes groove 512 in which flexible filaments 514 have been electrostatically flocked into a bonding agent 516 within groove 512. Thus, seal 500 is similar to seal 400, except that the flexible filaments are retrofitted onto the same member as incorporates the labyrinth teeth. In addition, the labyrinth teeth of seal 500 act as backers for the flexible filaments to prevent them from bending over due to a pressure drop.

*I would put this ahead of the previous idea. It's a better design as it allows for axial movement at the points.*

FIG. 6 depicts another embodiment of a brush seal 600 in accordance with the present invention. The brush seal is made between members 602 and 604, one of which rotates with respect to the other. Member 604 comprises groove 606 having various groove depths thereacross. Flexible filaments 608 have been electrostatically flocked into a bonding agent 610 within groove 606. The varying depths of groove 606 allow flexible filaments of the same length to extend different distances between members 602 and 604. It may be desired in some applications not to have all of the flexible filaments extending the same distance toward the corresponding member, for example, to reduce friction at start up. An alternative to FIG. 6 that also produces the different filament distances is actually cutting the filaments to the various desired lengths after the bonding agent hardens.

*A<sub>80</sub> provides a brush seal that incorporates the characteristics of a hi-lo labyrinth seal)*

FIG. 7 depicts still another embodiment of a brush seal 700 in accordance with the present invention. Brush seal 700 is made between members 702 and 704, with member 704 including multiple independent grooves 706, 708 and 710. Each groove comprises flexible filaments, such as flexible filaments 712 in groove 706, that have been electrostatically flocked into a bonding agent applied within the groove, e.g., bonding agent 714 in groove

706. The design of brush seal 700 allows for flexible filaments of all the same length with spaces in between groups of filaments.

FIG. 8 depicts yet another example of a brush seal 800 between members 802 and 804. Member 804 includes a separate member 806 (in this case, a ring) placed within a groove 807 of member 804. Member 806 includes flexible filaments 808 electrostatically flocked into a bonding agent 810. Since member 806 is separate from member 804, it allows the electrostatic flocking to be done prior to the coupling of member 806 and member 804. In some cases, however, member 806 may need to be attached to member 804 in two or more segments, for example, if it is a ring being put on the inside diameter of a turbine member. In addition, if the flexible filaments will be angled, it may also be advisable to angle the ring cut to correspond with the angle of the filaments, preventing a gap therein. In one scenario, member 806 comprises metal, as does member 804, and member 806 is welded into member 804.

P — brush seal applied to surface of one member (No groove)

The efficiency of a brush seal is affected by the cross-sectional shape of the individual filaments. In general, any cross-sectional shape with angles (i.e., non-circular) is better for reducing air or fluid flow than a circular cross-section, which produces <sup>more</sup> eddies around the filaments.

However, sharp angles may also cause abrasion with adjacent filaments. Thus, the angles of the non-circular cross-section are also preferably rounded or blunted, which may actually happen naturally during the process of making the filaments. For example, where the filaments are extruded and stretched, any corners may be rounded during the process.

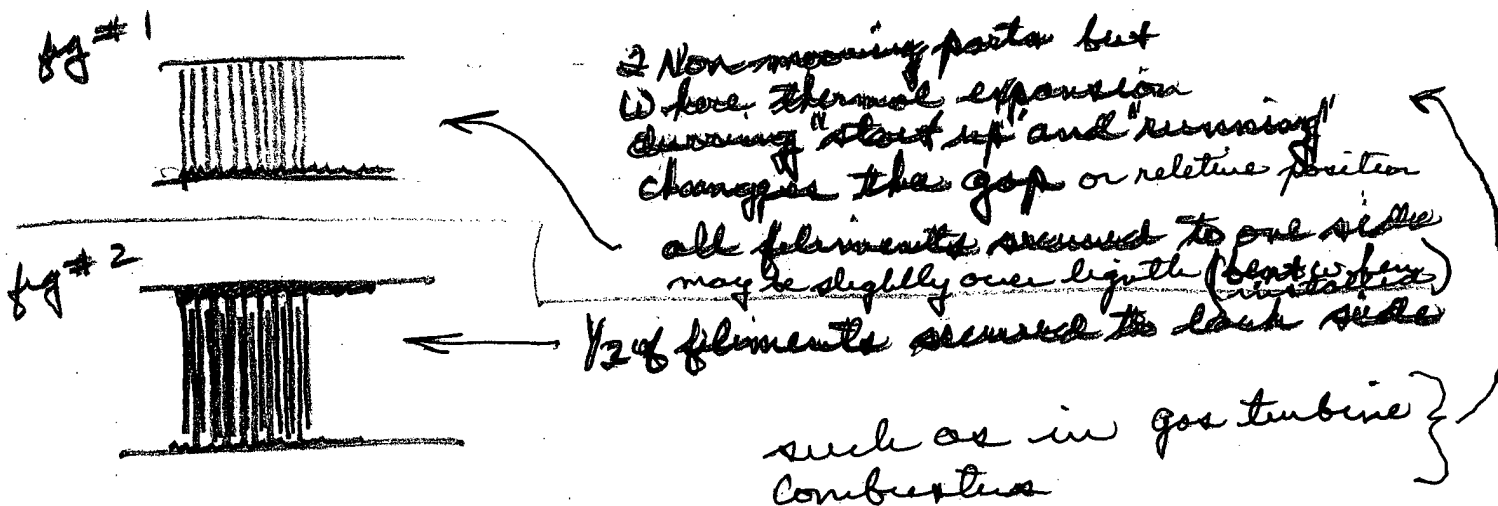
Examples of non-circular cross-sectional flexible filament shapes include various multi-point stars, and squares. ~~shapes with included angles~~ <sup>or convex sides</sup> would be best

random orientation of individual filaments relative to each other

actually sharp edges produce more eddies, so you want to make flow as turbulent as possible to minimize flow.

Need  
to add  
Figure 5

While several aspects of the present invention have been described and depicted herein, alternative aspects may be effected by those skilled in the art to accomplish the same objectives. For example, to serve a similar purpose as the labyrinth teeth of FIG. 5, one could add one or more backer rings to the brush seal of the present invention. Although a backer would reduce somewhat the achievable seal length for a given geometry, in some applications it may be desirable to prevent over-bending of the filaments from excessive pressure drops, for example. In addition, the invention is applicable anywhere there are members moving relative to each other and a majority (not necessarily all) of a gas or liquid flow is sought to be stopped. Accordingly, it is intended by the appended claims to cover all such alternative aspects as fall within the true spirit and scope of the invention.



-11-

CLAIMS

★ Add claims  
of about addition  
of anti-capillary  
action treatment  
to brushes

1. A method of creating a brush seal, comprising:

applying a bonding agent to a member; and

electrostatically flocking a plurality of flexible filaments into the bonding  
5 agent to create the brush seal.

2. The method of claim 1, further comprising creating a groove in the member,  
and wherein the applying comprises applying the bonding agent within the groove.

3. The method of claim 2, wherein creating the groove comprises creating the  
groove with at least two different depths.

- 10 4. The method of claim 1, wherein the brush seal is installed in a machine  
between a rotating member and a stationary member, and wherein the member is the rotating  
member.

5. The method of claim 1, wherein the brush seal is installed in a machine  
between a rotating member and a stationary member, and wherein the member is the  
15 stationary member.

6. The method of claim 1, wherein applying the bonding agent comprises  
applying a molten material to the member.

Both are stationary

Good  
catch!

-12-

7. The method of claim 6, wherein applying the molten material comprises applying a molten ceramic material. *with appropriate electrical conductivity*

8. The method of claim 6, wherein applying the molten material comprises applying a molten ~~braise~~ *[IS "BRAISE" THE RIGHT WORD?]* material. *Metal with appropriate electrical conductivity*

5 9. The method of claim 8, further comprising, prior to applying the molten ~~braise~~ material, applying a material in at least one area of the groove where an absence of the *stop off* plurality of filaments is desired to prevent the molten ~~braise~~ *BONDING* material from bonding to the member in the at least one area.

10. The method of claim 1, wherein the plurality of flexible filaments comprise at least one ~~electrically conductive~~ flexible filament, the method further comprising coating the *with the appropriate electrical conductivity* ~~at least one electrically conductive flexible filament with a~~ *material to achieve the appropriate electrical conductivity* ~~conductive flexible filament with a~~ *resistive filament* prior to the electrostatically flocking.

*same as 10 but reverse situation (add conductive coating to resistive filament)*  
11. The method of claim 1, wherein applying the bonding agent comprises applying an epoxy to the member.

15 12. The method of claim 1, wherein applying the bonding agent comprises applying an adhesive to the member.

13. The method of claim 1, wherein applying the bonding agent comprises rotating the member.

-13-

14. The method of claim 1, wherein the plurality of flexible filaments comprise at least one ~~electrically insulating~~ flexible filament. *with an appropriate electrical resistivity*  
OK —

15. The method of claim 1, further comprising repositioning at least some of the plurality of flexible filaments before the bonding agent solidifies.

5 16. The method of claim 15, wherein repositioning comprises angling ~~the~~ at least some of the plurality of flexible filaments with respect to a normal out of a surface of the member.

*me?* 17. The method of claim 1, wherein the brush seal is installed on a machine, the method further comprising coupling the member to the machine.

10 18. The method of claim 17, further comprising creating a groove in the machine, and wherein the coupling comprises placing the member in the groove.

19. The method of claim 1, wherein at least one of the plurality of flexible filaments has a non-circular cross-sectional shape.

*me?* 15 20. The method of claim 1, further comprising angling at least some of the plurality of flexible filaments.

21. A brush seal, comprising:

a member;

-14-

a bonding agent on a surface of the member;

a plurality of flexible filaments embedded in the bonding agent; and

wherein there is an absence of sealing rings coupling the plurality of flexible filaments to the member.

*I'm Abt 2 write  
since  
what  
this  
means  
(WAT)*

5           22.     The brush seal of claim 21, wherein the member is part of the machine.

23.     The brush seal of claim 22, wherein the member comprises a groove, and  
wherein the bonding agent resides in the groove.

24.     The brush seal of claim 23, wherein the groove has at least two different  
depths.

10          25.     The brush seal of claim 22, wherein the member comprises one of a rotating  
part and a stationary part.

26.     The brush seal of claim 21, wherein the brush seal is for coupling to a  
machine, and wherein the member is separate from the machine.

15          27.     The seal of claim 26, wherein the machine comprises a groove sized to fit the  
member therein.

-15-

28. The brush seal of claim 21, wherein the bonding agent comprises a material with a lower melting point than the plurality of flexible filaments.

29. The brush seal of claim 28, wherein the bonding agent comprises a ceramic material.

5           30. The brush seal of claim 28, wherein the bonding agent comprises a <sup>Molten metal</sup>~~brass~~ material.

31. The brush seal of claim 21, wherein the brush seal comprises at least one area having an absence of the plurality of flexible filaments.

10           32. The brush seal of claim 21, wherein the plurality of flexible filaments comprise at least one electrically conductive flexible filament coated with an electrical insulator. *of a given value*

33. The brush seal of claim 21, wherein the plurality of flexible filaments comprise at least one electrically insulative flexible filament *of a given value*

34. The brush seal of claim 21, wherein the bonding agent comprises an epoxy.

15           35. The brush seal of claim 21, wherein the bonding agent comprises an adhesive.

36. The brush seal of claim 21, wherein at least one of the plurality of flexible filaments is angled with respect to a normal out of the member.



-16-

37. The brush seal of claim 21, wherein at least one of the plurality of flexible filaments has a non-circular cross-sectional shape.

38. The brush seal of claim 21, wherein at least some of the plurality of flexible filaments are angled.

5 39. The brush seal of claim 21, wherein at least one backer on the member for at least some of the plurality of flexible filaments.

40. A system for creating a brush seal, comprising:

a bonding agent for applying to a member;

a plurality of flexible filaments; and

10 an electrostatic flocking machine for embedding the plurality of flexible filaments into the bonding agent to create the brush seal.

41. The system of claim 40, further comprising a [WHAT?] for creating a groove in a member on which the bonding agent is to be applied.

42. The system of claim 40, wherein the bonding agent comprises a ceramic  
15 material.

Do we  
need  
this  
claim  
(I assume  
a lathe  
is what  
would be  
used)

43. The system of claim 42, wherein the bonding agent comprises a ~~brass~~ *metal* material.
44. The system of claim 40, wherein the bonding agent comprises an epoxy.
45. The system of claim 40, wherein the bonding agent comprises an adhesive.
- 5 46. The system of claim 40, further comprising a material for applying in at least one area of a member on which the bonding agent is to be applied where an absence of the plurality of flexible filaments is desired to prevent the bonding agent from bonding to the member in the at least one area.
- 10 47. The system of claim 40, wherein the plurality of flexible filaments comprises at least one electrically conductive flexible filament coated with an electrical insulator.  
*of a given value*
48. The system of claim 40, wherein the plurality of flexible filaments comprises at least one *somewhat* electrically insulating flexible filament.
49. The system of claim 40, wherein the plurality of flexible filaments comprises at least one flexible filament having a non-circular cross-sectional shape. *the step of*
- 15 50. The system of claim 40, further comprising a **[WHAT?]** for angling the plurality of flexible filaments after embedding within the bonding agent and before the applied bonding agent solidifies.

51. The system of claim 40, wherein the electrostatic flocking machine comprises:

a flocking gun;

a compressor;

a hopper for holding the plurality of flexible filaments; and

5 means for producing a potential difference between the flocking gun and the member.

**METHOD, APPARATUS AND SYSTEM FOR CREATING A BRUSH SEAL****ABSTRACT OF THE DISCLOSURE**

A brush seal is created between two members, one rotating with respect to the other. In one member, a groove is created in which a bonding agent is applied. Flexible filaments  
5 are then electrostatically flocked into the bonding agent. After the bonding agent hardens or cures, the brush seal is created.

(M)

BANDING AGENT APPLICATION

BRUSH OR SPRAY APPLICATION

ROTATE PART SLOWLY  
(CYLINDRICAL PART)  
FOR UNIFORM  
DISTRIBUTION

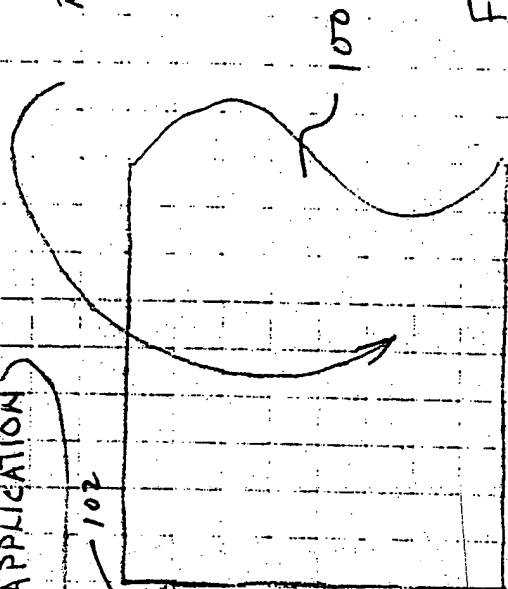


FIG. 1

FLOCKING PROCESS (ELECTROSTATIC)

Power supply

V.DC

ROTATE SLOWLY

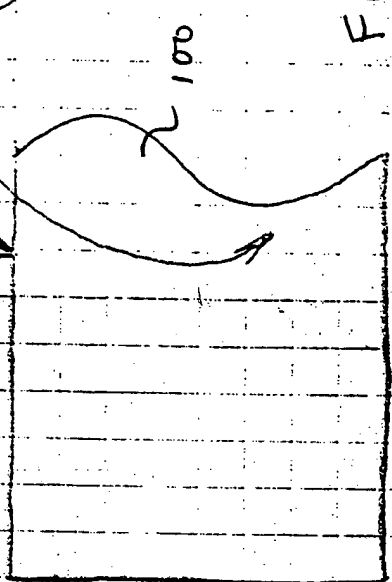
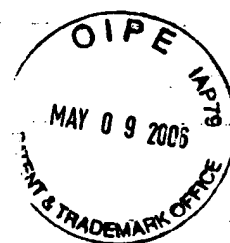


FIG. 2

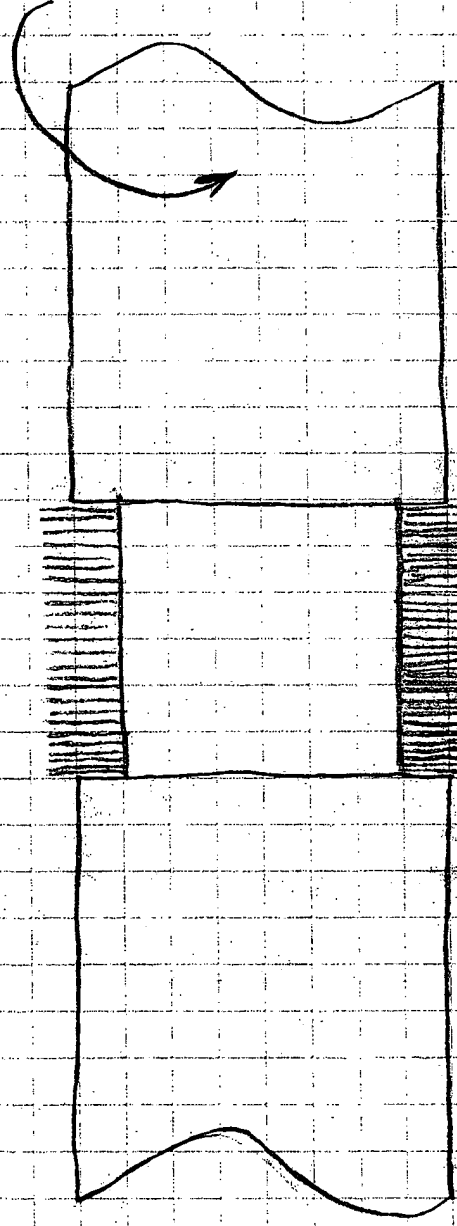


Control rotational speed, air pressure, and flocking material movement to achieve desired density

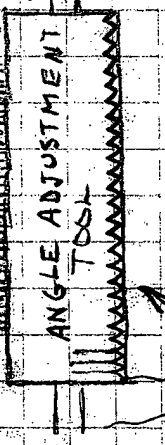
BRISTLE ANGLE ADJUSTMENT

FB 3

ROTATE PART SLOWLY



ANGLE ADJUSTMENT TOOL

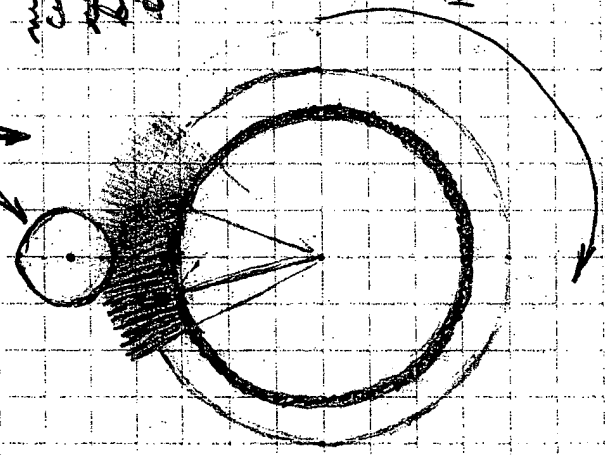


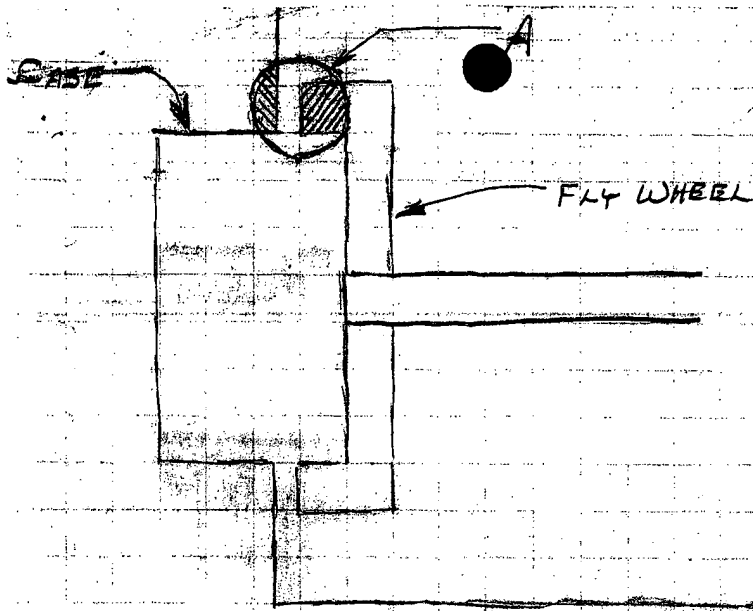
smooth face or grooved face

angle adjustment tool

must slowly turn cutting tool and adjust until angle is achieved

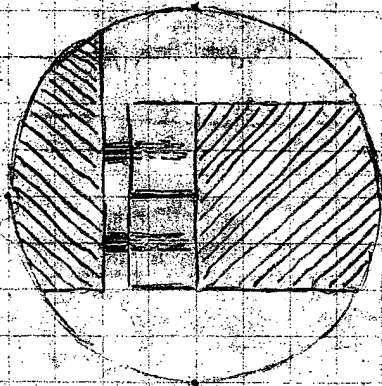
ROTATE SLOWLY



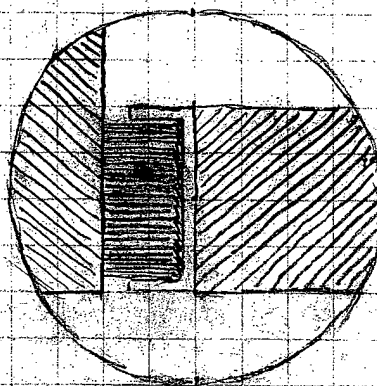


$\frac{1}{2}$ " AXIAL CLEARANCE  
 1" RADIAL SEAL LENGTH

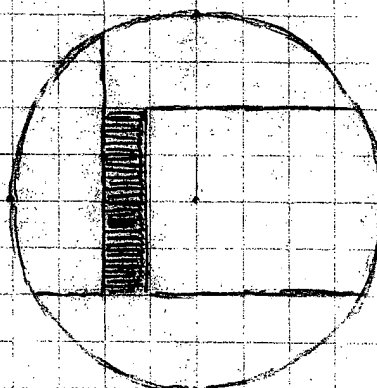
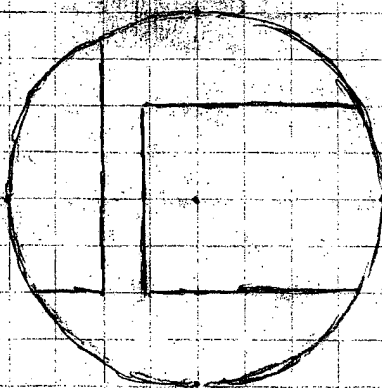
STANDARD BRUSH



ELECTROSTATICALLY  
 APPLIED BRUSH



$\frac{1}{2}$ " AXIAL CLEARANCE  
 1" RADIAL SEAL LENGTH



$\frac{1}{2}$ " AXIAL CLEARANCE  
 1" RADIAL SEAL LENGTH

7

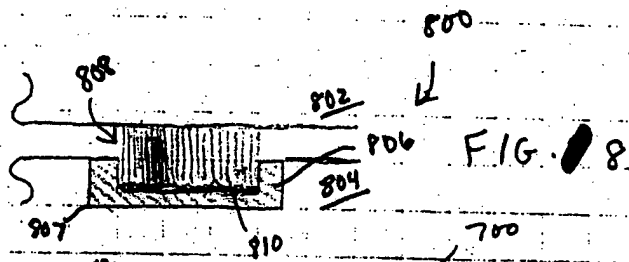


FIG. 8

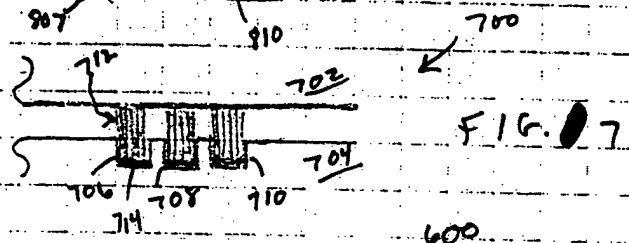


FIG. 7

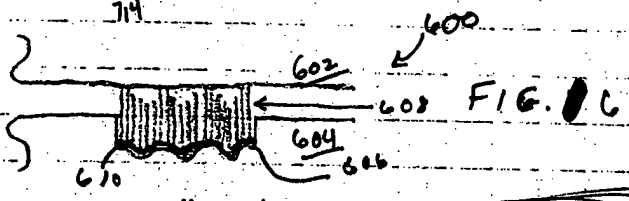


FIG. 6

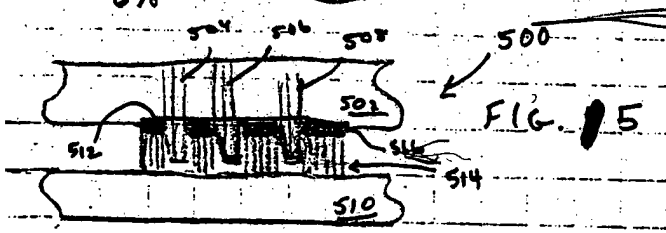


FIG. 5

make first sample

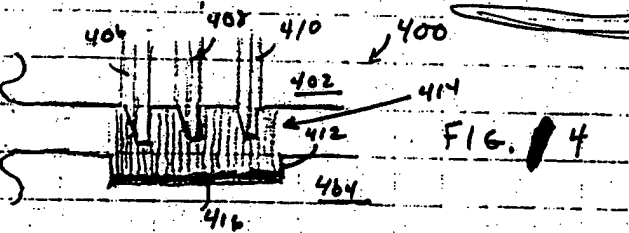
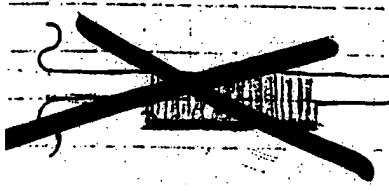


FIG. 4





RQS

✓  
LL

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APPLICATION NUMBER	FILING DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	DRAWINGS	TOT CLAIMS	IND CLAIMS
09/999,664	10/25/2001	3626	988	1370.002	6	70	7

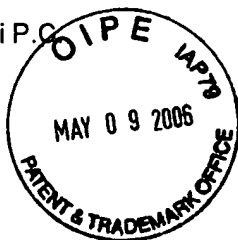
CONFIRMATION NO. 6770

## FILING RECEIPT



\*OC000000007206697\*

Wayne F. Reinke, Esq.  
Heslin Rothenberg Farley & Mesiti P.C.  
5 Columbia Circle  
Albany, NY 12203-5160



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## Applicant(s)

Walter J. Smith, Ballston Spa, NY;

Domestic Priority data as claimed by applicant

Foreign Applications

If Required, Foreign Filing License Granted 12/17/2001

Projected Publication Date: Request for Non-Publication Acknowledged

Non-Publication Request: Yes

Early Publication Request: No

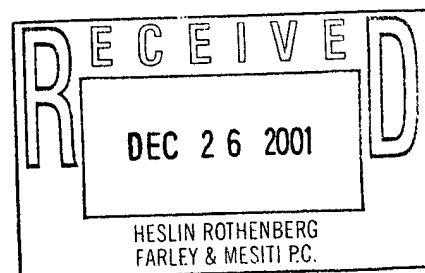
\*\* SMALL ENTITY \*\*

## Title

Method, apparatus and system for creating a brush seal

Preliminary Class

277



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# Heslin Rothenberg Farley & Mesiti P.C.

5 Columbia Circle  
Albany, New York 12203

Telephone (518) 452-5600

March 12, 2004

Mr. Walter J. Smith  
88 Chester Street  
Ballston Spa, NY 12020



Invoice # 98437      WR  
Our File # 1370-002A  
Billing Through 02/29/2004

## Method, Apparatus and System for Creating A Turbine Brush Seal

### PROFESSIONAL SERVICES

02/05/2004      Prepared for office conference with Walt Smith; office conference with Walt Smith.

### FEES

Member 1	2.50 Hours	\$562.50
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### Billing Summary

Total Professional Services	\$562.50
Total of New Charges for this Invoice	\$562.50
Less Trust Amount Applied to this Invoice**	\$562.50

Total Balance Now Due	<u><u>\$0.00</u></u>
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\*\*Trust Account Remaining balance is      \$3,437.50

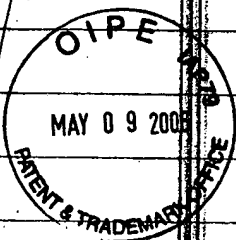
PAYMENT DUE UPON RECEIPT

2/5/04

need to come up w/ new term other than "included angle"

amendment re bonding agent maintaining properties above 350°F - art was found. supposedly

- rejection is Howe + our statement re steam turbines + art re high-temp adhesives.



- couple temp. w/ time stability  
↑  
new matter

385 CIP <sup>sec</sup>

(will review art re long-term at high temp)

\* - also fix typo in original. 1500 V for electrostatic

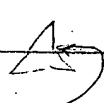
✓ flocking - should be ~~15,000~~ 50,000 V

✓ - also, at least claim 59 - should be  $10^8$  and  $10^{16}$

→ squares, hexagons already taken

W W

- n-point star <sup>shape</sup>, where  $n \geq 3$



↑ have to define or be comfortable w/ generally understood meaning

- "solid" center w/ "extensions" off of it

- "included  $\times$ " could be relatively sharp or rounded

- in description, ratio of radius of solid portion to radius from center to tip can vary from star to star

\* - 72 should read blunted "outer" point instead of corner

external =  
any thing  
some thing  
on outside  
of filament

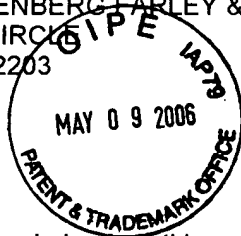


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APPL NO.	FILING OR 371 (c) DATE	ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	DRAWINGS	TOT CLMS	IND CLMS
10/805,084	03/19/2004	1733	950	1370.002A	7	78	4

23405  
 HESLIN ROTHENBERG FARLEY & MESITI PC  
 5 COLUMBIA CIRCLE  
 ALBANY, NY 12203



WR

CONFIRMATION NO. 7707

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\*OC000000012853356\*

Date Mailed: 06/03/2004

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## Applicant(s)

Walter J. Smith, Ballston Spa, NY;

## Domestic Priority data as claimed by applicant

This application is a CIP of 09/999,664 10/25/2001

## Foreign Applications

If Required, Foreign Filing License Granted: 06/02/2004

Projected Publication Date: 09/09/2004

Non-Publication Request: No

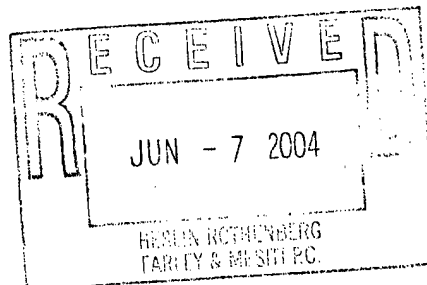
Early Publication Request: No

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## Title

Turbine brush seal

## Preliminary Class



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